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Bank Capital Regulation in the 1980s: Effective or Ineffective?

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During the early 1980s, objective minimum capital-to-asset ratio requirements replaced the earlier peer group type of capital regulation. This empirical study of the effects on the capital positions of the 100 largest BHCs finds that the regulations succeeded in causing banks with low capital ratios to increase their book value capital ratios both absolutely and relative to banks with initially high capital ratios, and that the banks did so primarily by slowing asset growth.

However, evidence on changes in market value capital ratios, while not necessarily inconsistent with the apparent book value capital increase induced by regulation, lends little independent support to the idea that regulation caused an actual increase in capital ratios.

As guarantor of a large portion of bank deposits, the Federal Deposit Insurance Corporation (FDIC) has a strong interest in ensuring that banks maintain adequate capital. Bank capital serves two purposes: it limits the exposure of the insurance fund to bank losses, and it limits banks' incentives to take excessive risks. Pursuant to this interest, the FDIC and the other banking regulatory agencies (the Office of the Comptroller of the Currency and the Federal Reserve) try to influence bank capital through supervision and regulation.

Prior to the 1980s, subjective capital standards, based on the results of the regulatory agencies' examinations of individual banking organizations, were the main form of capital regulation. Typically, regulators compared capital-to-asset ratios for bank peer groups (banks grouped by common characteristics such as asset size) and tried to ensure that banks with capital ratios lower than their peer group's average raised their capital ratios.

Largely because of the heightened concern over the risk exposure of the insurance system during the 1980s, the peer group type of capital regulation was replaced by specific minimum requirements. The risk exposure was increasing, it was believed, because of deteriorating asset quality, increases in off-balance sheet activity and declining capital ratios. The new capital requirements were intended to deal with these problems by causing banks with low capital ratios to increase them. Moreover, there was a desire to bring about more uniformity and objectivity in capital regulation. Consistent with these objectives, all banks and bank holding companies were required to hold primary capital at least equal to 5.5 percent of assets by June 1985.

There has been considerable debate over whether capital regulation is effective – specifically, whether regulators have succeeded in causing capital-deficient banks to increase their capital ratios. In the seminal paper on this subject, Peltzman (1970), using data from the 1963-1967 period, found no evidence that regulation affected banks' capital ratios. Although a later study by Mingo (1975), that examined the 1969-1970 period, seemed to find evidence of an effect, Dietrich and James (1973) argue that Mingo's findings were due to a failure to account for the effects of Regulation Q (deposit-rate ceilings) on banks' capital decisions.

In particular, during the 1969-1970 period analyzed by Mingo, banks were not permitted to raise interest payments to market-clearing levels even on large, uninsured deposits. As a result, banks may have boosted their capital ratios, thereby making their deposits safer and raising the expected yield, to compete for uninsured deposits. Consistent with this hypothesis, Dietrich and James find no evidence that capital regulation affected capital ratios during the 1971-1975 period when ceilings on most large deposits were not binding.[1]

This paper contributes to the literature on the effectiveness of capital regulation by examining the changes that took place in the 1980s. In many ways, this recent period is ideal for such a study because of the exogenous, explicit, and sweeping nature of those changes in capital regulation.

As in the previous literature, this study examines whether the new capital requirements caused banks with capital ratios below the minimum to raise their book value capital ratios to meet the new standards. However, unlike previous studies, this study also analyzes whether observed increases in book value capital represent an actual, market value capital infusion or whether they merely result from accounting changes. To address these questions, I examine, first, changes in banks' book value capital ratios caused by regulation; second, the sources of those changes; and third, the effects on market value capital-to-asset ratios using a measure based on stock prices.

The issue of whether a market value capital infusion took place is particularly important in judging the effectiveness of the capital regulations because the risk exposure of the insurance fund depends on the market values of banks' assets and liabilities – not their book values. For example, when a bank fails and is liquidated by the FDIC, the FDIC's loss equals the bank's liabilities minus the market value of its assets.

However, only book value capital-to-asset ratios – that is, ratios calculated using historical accounting values – are subject to regulation, and, there need not be a close correspondence between book and market values. For example, banks might respond to more stringent capital regulation by selling and then repurchasing appreciated assets. This would have the effect of increasing book value capital and assets by the amount of the capital gain and thereby increasing the book value capital-to-asset ratio, but it would not affect the market value ratio or the risk exposure of the deposit insurance system.

Even if the capital regulations of the 1980s succeeded in causing at least some banks to bolster their capital-to-asset ratios as my analysis suggests, a second related and important question remains: Did those banks that increased their capital ratios in response to the regulations react by increasing the asset risk of their portfolios in an effort to maintain a given rate of return? This question is addressed in an upcoming article in the Summer *Review* (Furlong, 1988). This issue is important because increased asset risk, potentially at least, could offset the beneficial effects of higher capital ratios on reducing the risk exposure of the deposit insurance system.

This paper is organized as follows. In Section I, I examine the effects of the capital regulations on book value capital ratios. I find that banks with low book value capital ratios did increase their ratios to meet the new standards introduced in the 1980s, apparently in response to the regulations. Therefore, it appears as though capital regulation is effective on average, at least in a book value sense.

Section II analyzes how the increase in book value capital was accomplished in order to assess whether it was the result of a true reduction in leverage or simply the result of accounting changes. The evidence indicates that banks increased their book value capital ratios mainly by slowing asset growth. This suggests that an actual increase in capital ratios did take place.

Section III then examines the effects on market value capital ratios to see if they are consistent with this interpretation. Although the patterns of changes in stock-price-based measures of market value capital ratios are consistent with an increase in actual capital under certain assumptions, they are consistent with several other hypotheses as well. Finally, Section IV presents a summary and conclusions.

I. Effects on Book-Value Capital Ratios

This Section analyzes whether the 1981-1985 capital regulations caused banks with capital below the minimum levels to raise (book value) capital, and thus whether the regulations reduced the disparity in capital ratios as intended. A brief description of the regulations is presented, after which their effects are analyzed.

Bank Capital Regulation: 1981-1985

In December of 1981, in a sharp departure from the past subjective form of capital regulation, the three federal bank regulatory agencies announced specific minimum capital standards. With the exception of the 17 largest banking organizations – the multinationals – minimum primary capital was set at 6 percent of assets for banks and bank holding companies with assets less than $1 billion, and 5 percent for organizations with assets of $1 billion or more.[2]

One of the stated purposes of this regulation was "...(to) address the sizable existing disparity in capital ratios among banking organizations of different size."[3] However, at the time the regulation was promulgated, actual differences in capital ratios were taken into account and the (trichotomous) capital standards apparently were set so that most organizations would meet the minimums.

Although the multinationals had very low capital levels and initially were exempted from the explicit minimum requirements for banks with assets over $1 billion (requirements which almost none of them would have met),[4] the agencies announced that their policies with respect to the multinationals would be amended "...(to) insure that appropriate steps are taken to improve over time the capital positions of banking organizations in this group."[5] Consistent with this goal, in June 1983, the 5 percent requirement was extended to the multinationals. Moreover, reflecting the original stated purpose of instituting objective and uniform minimum capital standards, in June of 1985, a uniform 5.5 percent minimum primary capital ratio was required for all banking organizations regardless of size.

Although a minimum primary capital ratio of 5.5 percent was set for all banks and bank holding companies (BHCs), a typical banking organization was expected to operate above the minimum ratio. Moreover, high-risk organizations were expected to hold even more additional capital.[6] Thus, if the regulations were effective, one would expect to see actual primary capital ratios average somewhat above the 5.5 percent level.

The evolution in capital regulation from trichotomous to dichotomous, and finally to uniform standards is consistent with the stated goals of the 1981 regulations – to bring uniformity over time in capital regulation. Thus, one might argue that the 1985 uniform standards were the ultimate objective even as early as December 1981. In keeping with this interpretation, this paper distinguishes the behavior of banks that would have met the 1985 requirements in 1981 from those that would not have. Throughout the paper, I refer to the former as capital-sufficient, and the latter as capital-deficient banks.

I also focus on primary capital (which consists mainly of common equity, loan loss reserves, and perpetual preferred stock) instead of total capital (which includes primary capital plus limited life preferred stock and subordinated notes and debentures) because primary capital requirements must be met in order to meet total capital requirements and because primary capital is somewhat easier to measure.

Data

The data used in my study come from the quarterly Bank Call Reports and the Compustat bank tapes, which contain balance sheet and income statements for the 150 largest bank holding companies whose stock is publicly traded. Although this sample of 150 BHCs is not representative of the entire population of all banks or bank holding companies, which consists of many smaller and often privately held banks and bank holding companies as well, the BHCs in this sample hold about 40 percent of all bank assets and thus are of interest in their own right.

The Compustat sample also is subject to selectivity (survivor) bias since it consists only of banks currently in existence. Thus, banks that have failed or that were acquired are not included in the sample. The exclusion of failed or acquired banks might bias the study toward finding that capital regulation was effective since banks not meeting the requirements would be more likely to fail or be acquired and thus not be included in the sample. Moreover, complete historical data are not available for the entire sample of 150 banks. To deal with this second problem, I focus on a subsample of 103 banks for which data are available over the entire analysis period. Thus, the results may only apply to a subsample of large publicly traded banks that have not failed or been acquired.

Effects of Regulations on Book Capital Ratios

Chart 1 shows an overall downward trend until 1981 in the mean of the primary book capital ratio for a sample of large, publicly traded banks over the 1965-1986 period. This downward trend is part of a longer down-

ward trend that began as early as 1956 (see Keeley and Furlong, 1987).

However, the downward trend apparently has reversed since 1982, perhaps partly as a result of the imposition of objective capital regulation in December 1981.[7] An alternative explanation is that some external factor, such as a change in the economic environment, caused the capital ratios of banks to increase on average. However, if capital regulation itself had an effect, one would expect the capital ratios of those banks initially not meeting the requirements (that is, the capital-deficient banks) to rise relative to those meeting them (the capital-sufficient banks). Moreover, one would expect that, eventually, the capital ratios of the two groups would be indistinguishable.

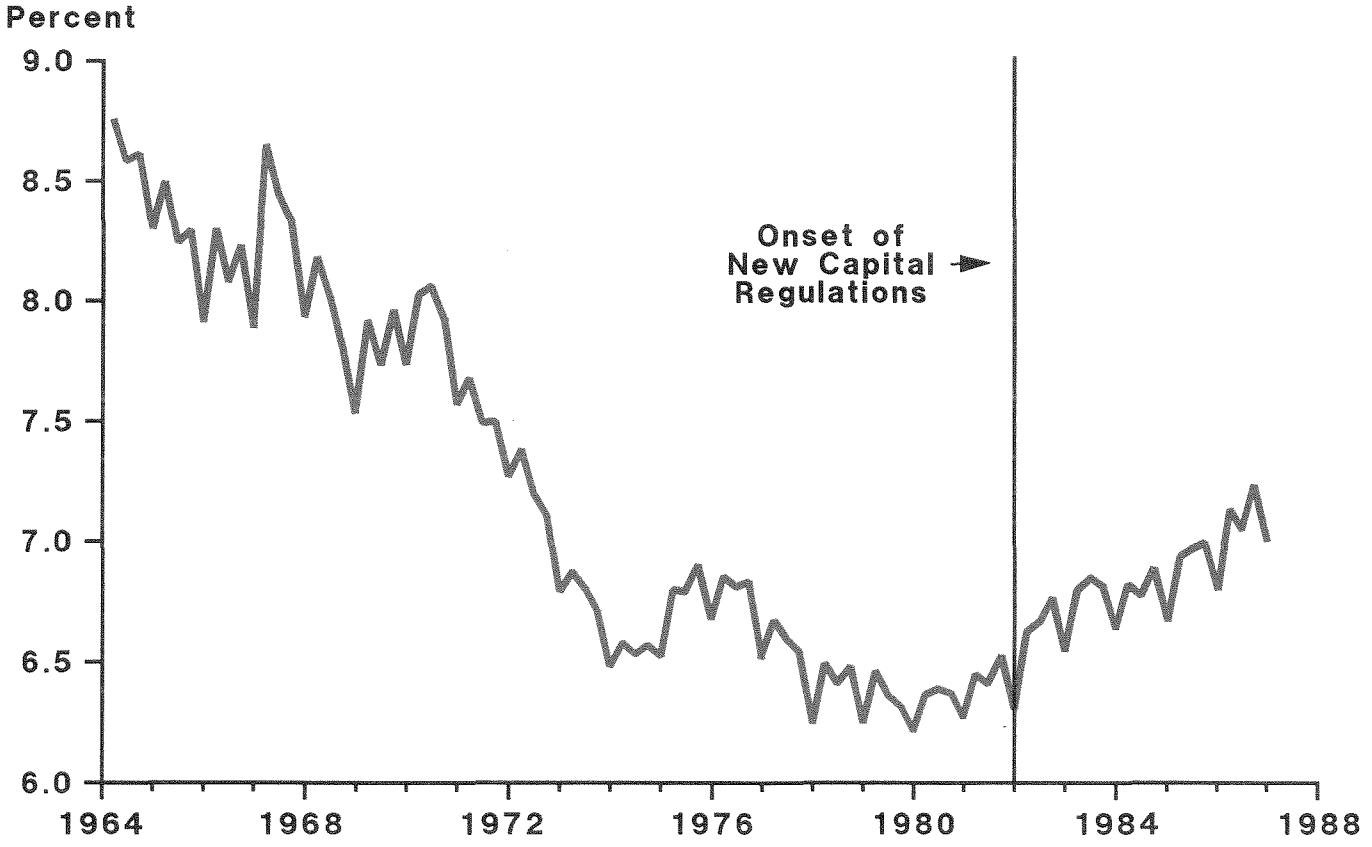
In Chart 2, mean primary book capital-to-asset ratios are plotted separately for capital-sufficient and capital-deficient banks. The chart shows that capital-deficient banks did increase their capital ratios relative to the capital-sufficient banks – a pattern consistent with the hypothesis that regulation caused the increase in capital ratios. Moreover, the increase was gradual over the 1982-1986 period, which is consistent with the stated goal of the 1981 requirements to induce capital-deficient banks to augment capital over time.

Chart 3 plots the percent of banks in each group meeting the 1985 requirements over time. This chart confirms that by 1986 about 90 percent of the capital-deficient banks were meeting the 1985 capital requirements. Thus, it appears that by 1986, capital requirements were effective in the sense that virtually all of the banks in the sample were complying with the minimum book requirements. While the increase in capital standards over this period might have been a reaction by regulators to a perceived increase in bank risk (due perhaps to the LDC debt crisis) and thus was not fully exogenous, the results nevertheless suggest that capital regulation was effective in boosting banks' capital ratios higher than they would have been in its absence.

In the next part of this section, an overview of some of the key differences in the characteristics of the capital-deficient and capital-sufficient banks is presented. Then

CHART 1

PRIMARY BOOK CAPITAL-TO-ASSET RATIO REVERSED DOWNWARD TREND IN 1982



the group of capital-sufficient banks is used as a control group against which the behavior of the capital-deficient banks is compared. This comparison permits statistical estimation of the response of the capital-deficient banks to the capital regulations of the 1980s.

Bank Characteristics

Mean values of several characteristics of both capital-deficient and capital-sufficient banks are presented in Table 1. Perhaps the most overriding difference is that 63 percent of the capital-deficient banks are multinationals, in contrast to only 1 percent of the capital-sufficient banks. As a result, the capital-deficient banks are much larger ($129 billion of assets compared to $19 billion), have more foreign deposits (35 percent of total deposits compared to 8 percent), have a smaller fraction of retail-type deposits (demand and savings), and are more heavily involved in issuing standby letters of credit (SLCs).

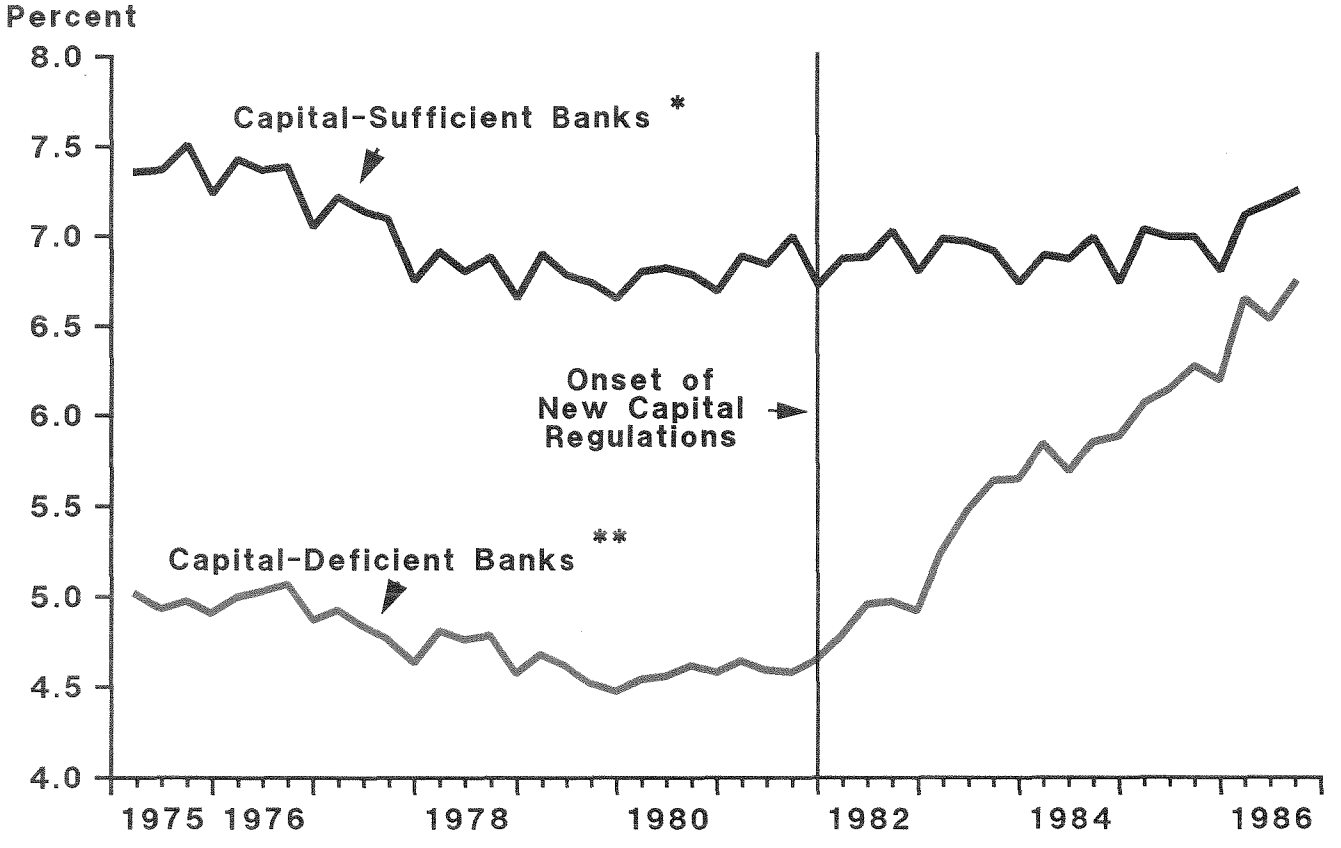
One of the possible reasons the capital-deficient group had lower capital ratios in 1981 was that, prior to that time, this group of banks was believed to have been less risky. The group therefore would have required less capital because their larger size and multinational scope allowed for more diversified portfolios. However, the onset of the LDC debt crisis and other economywide shocks called for a re-evaluation. Thus, it appears that one of the major goals of the series of new capital regulations promulgated in the early 1980s was to bolster the capital ratios of the multinationals as well as other banks with low capital ratios.

Statistical Analysis of Book Capital Ratios

Chart 3 suggests that capital-deficient banks gradually adjusted their capital ratios over the 1982-1986 period to eventually meet or exceed the 1985 require-

CHART 2

CONVERGING TRENDS IN PRIMARY BOOK CAPITAL-TO-ASSET RATIOS



* *Banks that met 1985 requirements in 1981.*

** *Banks that did not meet 1985 requirements in 1981.*

ments. Table 2 confirms this with a comparison of mean primary book capital ratios at selected points in time for the capital-sufficient and capital-deficient groups.

Table 2 shows that the difference in the means of the two groups fell from 2.27 percentage points in 1981 to just .56 percentage points by 1986. Moreover, the difference declined each year, mostly due to increases in the capital ratios of the capital-deficient group. In fact, the mean capital ratio of the capital-deficient banks increased by 2.02 points in comparison to only a .31 point increase for the capital-sufficient banks over the 1981 through 1986 period – a statistically significant difference of 1.71 points. The apparent rise of .31 points of the capital-sufficient group, which took place mainly between 1984 and 1986, may have been due to the .50 point rise in minimum primary capital for BHCs with assets of $1 billion or more (a characteristic of most of the capital-sufficient banks in the sample) that became effective in June of 1985.

Desired Book Capital Ratios

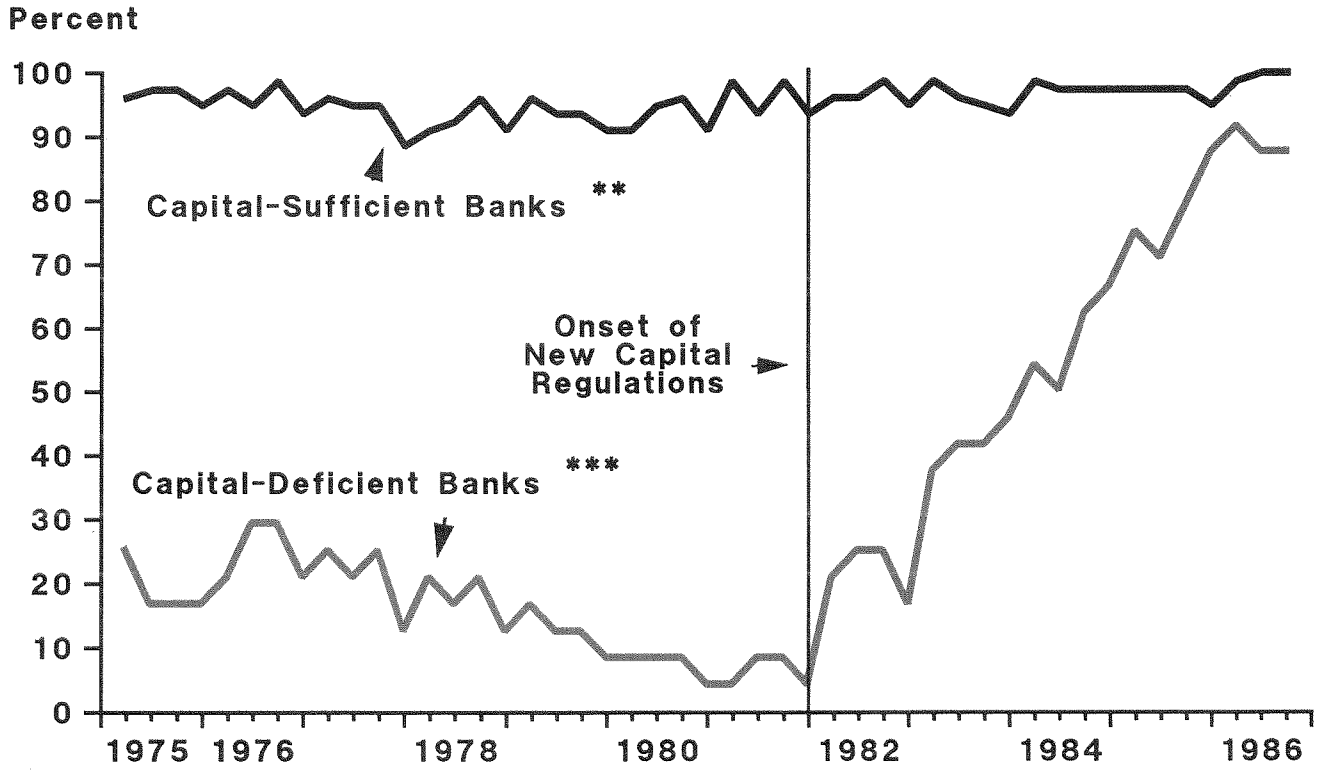
This pattern of gradual adjustment is exactly what might be expected given that the new regulations were phased in over the 1982-1985 period and that the 5.5 percent statutory minimum requirement did not become effective until June of 1985. Because adjustment of capital is costly and thus takes places slowly, the actual average capital ratios over the 1982-1986 period presented in Table 2 may not reflect the long-run levels toward which the banks apparently were aiming. However, by making some assumptions about the adjustment process, it is possible to estimate statistically the long-run level. The model follows.

Assuming that a bank has a target capital-to-asset ratio of c* and that in each period it adjusts a fraction, b, of the difference between its actual and target ratio, the change in the actual capital ratio would be:

$$c_t - c_{t-1} = b(c^* - c_{t-1}). \quad (1)$$

CHART 3

PERCENT OF BANKS MEETING THE 1985 REQUIREMENTS INCREASES AFTER 1982*



* *The percent of capital sufficient banks is less than 100% and the percent of capital sufficient banks is greater than zero in each quarter of 1981 because capital sufficiency is defined on an annual basis.*

** *Banks that met the 1985 requirements in 1981.*

*** *Banks that did not meet the 1985 requirements in 1981.*

Moving c_{t-1} to the righthand side of equation 1 and allowing for other unrelated (random) influences on capital ratios, e_t, gives:

$$c_t = bc^* + (1 - b)c_{t-1} + e_t. \quad (2)$$

Equation 2 is used to estimate both the desired or target capital level, c*, and the speed of adjustment, b, separately for the capital-deficient and capital-sufficient banks both before and after the period of changing capital regulation that began in 1982.

If the new capital regulations had their intended effects, one would expect the target capital ratios of both groups of banks to exceed the guidelines during the post-1982 period. Moreover, one would expect the target capital ratios in the post-1982 period for capital-deficient banks not to differ significantly from the target capital ratios of the capital-sufficient banks.

Table 1

1981 Characteristics of Capital-Deficient and Capital-Sufficient Banks

(Standard Errors in Parentheses)

Characteristics	Capital-Deficient Banks	Capital-Sufficient Banks	Difference
n	24	79	
Assets (in billions of dollars)	$129.2 (27.57)	$18.6 (1.63)	−110.6** (27.62)
Percentage Multinational	63% (10%)	1% (1%)	−62%** (10%)
Demand Deposits & Savings Deposits / Total Deposits	0.38 (.036)	0.50 (.0094)	.12** (.04)
Foreign Deposits / Total Deposits	0.35 (.044)	0.080 (.011)	−.27** (.05)
Treasury Securities & Cash & Other Government Securities / Total Assets	0.28 (.012)	0.26 (.0077)	−.02 (.014)
Loan Loss Reserves / Total Loans	0.011 (.00056)	0.011 (.00024)	0.00 (.00078)
SLCs* / Assets	.049 (.0074)	.019 (.0015)	−.030** (.0008)
Primary Capital Ratio*	4.63 (.13)	6.73 (.13)	2.10** (.18)
Market Value Capital Ratio*	2.82 (.23)	4.88 (.18)	2.06** (.29)

** 4th Quarter 1981*

*** Significant at the 1 percent level*

In Table 3, estimates are presented of the model described by Equation 2. The estimates are from four pooled-time-series-cross-section nonlinear regressions for the two periods (before and after 1982) and for the two groups (capital-deficient and capital-sufficient banks). The equations are estimated by nonlinear least squares, and the standard error of each difference is equal to the square root of the sum of the variances of the two parameters since the covariances are zero.

The results suggest that capital-deficient banks did increase their target capital levels by a statistically significant (at the 1 percent level) 2.5 percentage points compared to only a .48 percentage point increase for the banks for which the requirements were not binding. (The .48 point increase for the capital-sufficient banks may be due to the rise in minimum primary capital requirements from 5 to 5.5 percent in June 1985 for banks with $1 billion or more in assets.)

Moreover, although prior to the imposition of the new capital standards, the capital-deficient group had target capital ratios 2 percentage points below that of the capital-sufficient group, during the 1982-1986 period there was no statistically significant difference between the two groups. Thus, the .56 point difference in 1986 actual capital ratios shown in Table 2 appears to be due to incomplete adjustment.

The larger increase in the capital ratios of the capital-deficient banks is consistent with the hypothesis that the new capital requirements were the cause of most of the increased capital. Moreover, the lack of a statistically significant difference in the target ratios of the two groups suggests that the requirements will eventually eliminate the disparity in actual capital ratios.[8]

The results in Table 2 and 3 suggest that, after the new regulations became effective, banks' actual and target book capital ratios on average exceeded the minimum

Table 2

Mean Primary Book Capital Ratios, Selected Points in Time

(Standard Errors in Parentheses)

Period	Capital-Deficient Banks	Capital-Sufficient Banks	Difference*
1974Q4–1981Q4	4.73	7.00	2.27
	(.029)	(.028)	(.040)
1982Q1–1986Q3	5.75	6.95	1.20
	(.044)	(.029)	(.053)
1981	4.60	6.87	2.27
	(.066)	(.066)	(.093)
1982	4.89	6.90	2.01
	(.062)	(.077)	(.099)
1983	5.48	6.90	1.42
	(.076)	(.072)	(.10)
1984	5.80	6.88	1.08
	(.088)	(.058)	(.10)
1985	6.15	6.95	.80
	(.077)	(.053)	(.093)
1986Q1–Q3	6.62	7.18	.56
	(.099)	(.054)	(.11)

* *All estimates significant at the 1 percent level.*

Table 3

Book Value Primary Capital-to-Asset Ratio Long-Run Desired or Target Level of Capital and Speed of Adjustment

(Standard Errors in Parentheses)

	1975Q1–1981Q4	1982Q1–1986Q3	Difference
Capital-Deficient Banks			
Desired Level (percent)	4.68*	7.18*	2.50*
	(.13)	(.47)	(.49)
Speed of Adjustment (percent/quarter)	7.67*	7.08*	–.59
	(1.29)	(1.85)	(2.26)
Capital-Sufficient Banks			
Desired Level (percent)	6.68*	7.16**	.48**
	(.19)	(.11)	(.22)
Speed of Adjustment (percent/quarter)	3.82*	11.59*	4.77*
	(.53)	(1.13)	(1.25)
Difference			
Desired Level	2.00*	–.02	–2.02*
	(.23)	(.23)	(.54)
Speed of Adjustment	–3.85**	4.51**	5.36**
	(1.39)	(2.17)	(2.58)

* *Significant at the 1 percent level*
** *Significant at the 5 percent level*

required ratio (which was only 5.5 percent). During a period of explicit minimum requirements such a capital buffer might be expected for several reasons.[9] First, as mentioned previously, regulators expected typical banks to maintain primary capital ratios somewhat above the minimum, and they expected banks with riskier portfolios to maintain capital ratios substantially above the minimum. Moreover, minimum total capital required was 6 percent and "adequate" total capital was 7 percent, which some banks met by holding primary capital of 6 percent or more.

Second, capital ratios are not perfectly predictable. As a result, banks might want to hold a buffer stock to avoid regulatory penalties should a random shock cause them to fall below the required ratio. Third, it may be costly to raise capital, at least over a short period. Thus, banks may want to hold a capital buffer to allow for unexpected growth opportunities without violating the capital guidelines. Finally, bankruptcy and agency costs may provide a nonregulatory explanation for why at least some banks would want to hold capital in excess of the required amount.

The results in Table 3 also suggest that the speed of adjustment toward target capital levels increased substantially for the capital-sufficient banks (from 3.82 to 11.59 percent per quarter) but did not significantly change for the capital-deficient banks.

One interpretation of these findings is simply that regulators may have become less tolerant of capital ratios below the statutory minimum requirements once they were in place. Capital-deficient banks, in essence, were allowed the entire December 1981 through June 1985 period to adjust to the new requirements, whereas capital-sufficient banks, for the most part, had to meet the requirements immediately. If this were true, one would expect the speed of adjustment to increase after 1981, as I found it did for capital-sufficient banks. However, this same type of increase did not occur for the group of capital-deficient banks because capital requirements for the multinationals, which comprise the bulk of this group, were set in two phases in June 1983 and June 1985.

Table 4

Quarterly Standard Deviations of Primary Book Value Capital Ratios Across Banks: Averages Over Time
(Standard Errors in Parentheses)

Categories of Banks	1975Q1–1981Q4	1982Q1–1986Q3	Difference
All Banks	1.54	1.16	–0.38*
	(.037)	(.045)	(.059)
Capital-Deficient Banks	0.76	0.76	–0.01
	(.024)	(.029)	(.37)
Capital-Sufficient Banks	1.30	1.10	–0.20*
	(.037)	(.045)	(.058)

* *Significant at the 1 percent level*

The Standard Deviation of Book Capital Ratios

One of the goals of the new capital regulations was more uniform capital regulations, as reflected in the uniform minimum 1985 requirements. If these requirements were a major determinant of capital ratios, one would expect to see a decline in the dispersion of capital ratios across banks as all banks aimed to reach capital ratios near the minimum required level (plus a buffer).

Moreover, since the previous results suggest that capital regulations had their intended effects of causing increases in the capital levels of the capital-deficient banks relative to capital-sufficient banks, one would expect the standard deviation of capital ratios across all banks to decline after uniform minimum standards were introduced, especially after they had completed their adjustment to the new minimum requirements. Also, since the speed of adjustment increased for capital-sufficient banks, as long as the target ratios of different banks were similar, one might expect a larger decrease in the standard deviation of their capital ratios than in those of the capital-deficient banks. The reason is that a faster speed of adjustment toward a uniform target ratio means that more banks will be near the target ratio at any time.

Table 4 presents evidence relating to the changes in the standard deviation of capital ratios across banks for three groups of banks: 1) all banks in the sample, 2) capital-deficient banks, and 3) capital-sufficient banks. First, I computed the standard deviation of the primary book capital-to-asset ratio across the banks in a particular group for each quarter. Then I tested whether the average over time of these cross-sectional standard deviations during the 1982-1986 period is lower than the average during the 1975-1981 period.

The results in Table 4 suggest that the mean standard deviation of the primary capital ratio across all banks fell from 1.54 to 1.16. Moreover, they do not allow the hypothesis that the standard deviation across capital-

deficient banks was unchanged to be rejected, whereas they do indicate that the standard deviation across capital-sufficient banks declined by a statistically significant amount. In addition, the standard deviation across all banks declined more than the standard deviation of capital-sufficient banks, suggesting that differences among banks in the two groups also declined – a result consistent with the intent of the regulations.[10]

One would expect the standard deviation of capital ratios of the capital-sufficient group of banks to exceed that of the capital-deficient group before the change in regulation took place. The reason is that capital-sufficient banks' capital ratios all exceeded 5.5 percent and had no upper limits. However, the capital-deficient group had capital ratios between zero and 5.5 percent. After the new regulations were promulgated, one might expect a tighter clustering of the capital ratios of the capital-sufficient group around the new target level if some of the banks with high capital ratios allowed the ratios to fall below the minimum. One also would expect little change in the dispersion of capital ratios for banks that had an incentive to operate at the minimum allowed ratio – apparently a characteristic of many of the capital-deficient banks.

II. How the Increase in Book Capital Ratios Came About

The previous results suggest that capital regulation, in keeping with its stated objectives, did have an influence on book capital ratios. However, they leave open the question of whether this result was due to a market-value capital infusion (relative to assets) or to accounting gimmicks. As mentioned previously, this issue is important because the risk-exposure of the insurance fund depends on the market value capital-to-asset ratio, not the book value ratio.

One commonly used accounting technique that would boost book capital without a change in market-value capital is the selective realization of capital gains through the sale of appreciated assets and the purchase of other assets with the proceeds. The difference between the book and current values of the appreciated asset would raise book capital and assets each by the amount of the gain, and thereby cause the book capital ratio to increase even though nothing changed on the bank's market-value balance sheet.

Another possible method of disguising leverage is through off-balance sheet banking. For example, by issuing standby letters of credit (SLCs) banks can in effect fund assets off balance sheet with off-balance sheet liabilities issued with recourse. Doing so has identical effects on banks' market value leverage as funding assets on their balance sheets.

Thus, it is at least possible that banks met the new capital standards simply by using accounting techniques, and that no real change in banks' balance sheets occurred.

Alternatively, banks may have increased their capital-to-asset ratios either through an increase in market value capital, holding assets constant, or through a decrease in assets, holding capital constant. Capital may be increased, holding assets constant, either by issuing additional equity or by retaining earnings. Assets may be reduced, holding capital constant, by selling assets and using the proceeds to retire liabilities.

Perhaps the easiest way to see how the capital-to-asset ratio can change over time is to differentiate the ratio of capital, C, to assets, A, with respect to time:

$$\frac{d(C/A)}{dt} = (C/A)\left[(1/C)\frac{dC}{dt} - (1/A)\frac{dA}{dt}\right] \qquad (3)$$

Equation 3 indicates that the rate of change of the capital-to-asset ratio equals the percentage growth rate of capital minus the percentage growth rate of assets times the initial capital-to-asset ratio. Thus, banks can increase their capital ratios by either increasing capital growth relative to asset growth or vice versa.

Capital and Asset Growth Rates

The data in Table 5 indicate that capital-deficient banks increased their capital ratios mainly by slowing asset growth. In the table, both mean annual capital and asset growth rates (continuously compounded) before and after the change in regulation were calculated separately for capital-deficient and capital-sufficient banks.

Capital-deficient banks dramatically lowered their rate of asset growth, both relative to their asset growth rates during the 1975-1981 period and relative to the growth rates of capital-sufficient banks, by a large (6.44 point) statistically significant amount. Thus, slower asset growth appears to be the main way that capital-deficient banks increased their capital-to-asset ratios relative to capital-sufficient banks.[11]

Capital-deficient banks also increased their rate of capital growth from 9.13 to 14.40 percent per year. This increase appears to be somewhat greater (.42 points) than the increase in the growth rate of capital for capital-sufficient banks, but the difference is not statistically significant. Thus, higher capital growth alone only partly explains the increase in capital ratios of capital-deficient banks relative to capital-sufficient banks.

One reason that slowing asset growth may have been used to increase capital ratios is that the method probably involves few, if any, transactions costs, and may not send the same types of adverse signals to the capital market that are claimed to be associated with new equity issuance or a reduction in dividend payout rates.[12]

Since slower asset growth would not result from selectively realizing capital gains and using the proceeds to acquire new assets (that would result in more rapid asset growth), the results suggest, but certainly do not prove, that this accounting method does not solely account for the increased capital-to-asset ratios of the capital-deficient group of banks relative to the capital-sufficient group. Although appreciated assets could have been sold and used to retire liabilities, thereby overstating the resultant decrease in book value leverage, such actions still would reduce market value leverage.[13]

Table 5

Means of Continuously Compounded Annual Growth Rates of Book Capital and Book Assets

(Standard Errors in Parentheses)

	1975Q1–1981Q4	1982Q1–1986Q3	Difference
All Banks			
Primary Book Capital	9.78	14.72	4.94*
	(.44)	(.74)	(.86)
Primary Book Assets	10.94	12.08	1.14
	(.43)	(.84)	(.94)
Capital-Deficient Banks			
Primary Book Capital	9.13	14.40	5.27*
	(1.03)	(1.10)	(1.51)
Primary Book Assets	10.07	7.14	–2.93
	(1.13)	(1.44)	(1.83)
Capital-Sufficient Banks			
Primary Book Capital	9.97	14.82	4.85*
	(.47)	(.90)	(.99)
Primary Book Assets	11.21	13.58	2.37
	(.46)	(.94)	(1.05)
Difference			
Primary Book Capital	0.84*	0.43	–0.42
	(1.13)	(1.42)	(1.81)
Primary Book Assets	1.14**	6.44**	5.30**
	(1.22)	(1.72)	(2.11)

* *Significant at the 1 percent level*

** *Significant at the 5 percent level*

Off-Balance-Sheet Banking

As mentioned above, banks could have evaded the capital regulations while still slowing asset growth by shifting existing assets and liabilities off their balance sheets or by funding new assets off balance sheet with off-balance-sheet liabilities issued with recourse. Loans sold with recourse and standby letters of credit (SLCs), for example, have cash flows identical to funding loans on balance sheet with no capital. Although loans sold with recourse are included in the balance sheet measures, SLCs are not.

Thus, if the increase in book capital ratios simply represents shifts of assets and liabilities (with recourse) off balance sheet, the capital regulations would have been ineffective. To test for this possibility, I recomputed capital ratios as if the loans backed by SLCs had been funded with on-balance-sheet bank liabilities. The results are displayed in Table 6.

Table 6 shows that incorporating SLCs on the balance sheet does lower capital ratios, especially for the capital-deficient banks. However, there is still an increase in

average book capital from 4.45 percent in the last quarter of 1981 to 6.06 by the third quarter of 1986 for capital-deficient banks. Thus, while the increases in traditional on-balance-sheet measures of book capital somewhat overstate the true book capital increase (by about 27 percent), consolidated (on-and-off-balance-sheet) book capital ratios increased for the capital-deficient banks both absolutely and relative to the capital-sufficient banks by a statistically significant amount.

III. Market-Value Capital

The above results suggest that banks did comply with the capital regulations, at least in a book-value sense. If deposit insurance were fairly priced and no accounting tricks were used to augment book-value capital-to-asset ratios, then, *ceteris paribus,* one would expect market-value capital-to-asset ratios to increase one-for-one with book measures. Thus, the behavior of market-value capital ratios also potentially provides information on whether the change in book capital-to-asset ratios was genuine or the result of accounting changes.

Ideally, one would like to measure the market value of each bank asset (not including the potential value of underpriced deposit insurance) and liability to compute the market-value capital-to-asset ratio. Unfortunately, such a procedure is not possible because neither detailed

Table 6

Primary Capital-to-Asset Ratios, Actual and Adjusted to Incorporate SLCs

(Standard Errors in Parentheses)

	1977Q1	1981Q4	1982Q1	1986Q3	1986Q3 minus 1981Q4*
Capital-Deficient Banks (n = 19)					
Actual	4.81	4.65	4.78	6.59	1.94
	(.16)	(.13)	(.14)	(.20)	(.23)
Adjusted	4.73	4.45	4.55	6.06	1.53
	(.16)	(.14)	(.15)	(.23)	(.27)
Capital-Sufficient Banks (n = 65)					
Actual	7.17	6.71	6.85	7.27	.56
	(.18)	(.14)	(.14)	(.11)	(.18)
Adjusted	7.12	6.60	6.73	7.03	.43
	(.18)	(.14)	(.14)	(.11)	(.18)
Differences*					
Actual	−2.36	−2.06	−2.07	−.68	1.38
	(.25)	(.19)	(.20)	(.23)	(.29)
Adjusted	−2.39	−2.15	−2.18	−.97	1.10
	(.25)	(.20)	(.21)	(.25)	(.32)

* *All estimates significant at the 1 percent level.*

balance sheet data nor data on the market value of bank assets are available.

However, it is possible to measure the market value of bank equity (price per share times number of shares). And, assuming liabilities have par (book) value, the market value of assets equals the sum of the market value of equity plus the book value of liabilities. Thus, it is possible to compute a stock-price-based measure of the market value capital-to-asset ratio.

The problem with this measure, however, is that the *ceteris paribus* condition may not hold. Many factors including changing regulatory taxes and subsidies can affect bank stock prices yet not directly affect the risk exposure of the insurance fund. Nevertheless, changes in this measure may provide useful information.

Chart 4 shows that the means of the equity-based market value capital ratios rose rather dramatically for both capital-deficient and -sufficient banks. However, unlike the results for book capital ratios, the increase for capital-deficient banks is not apparently larger.

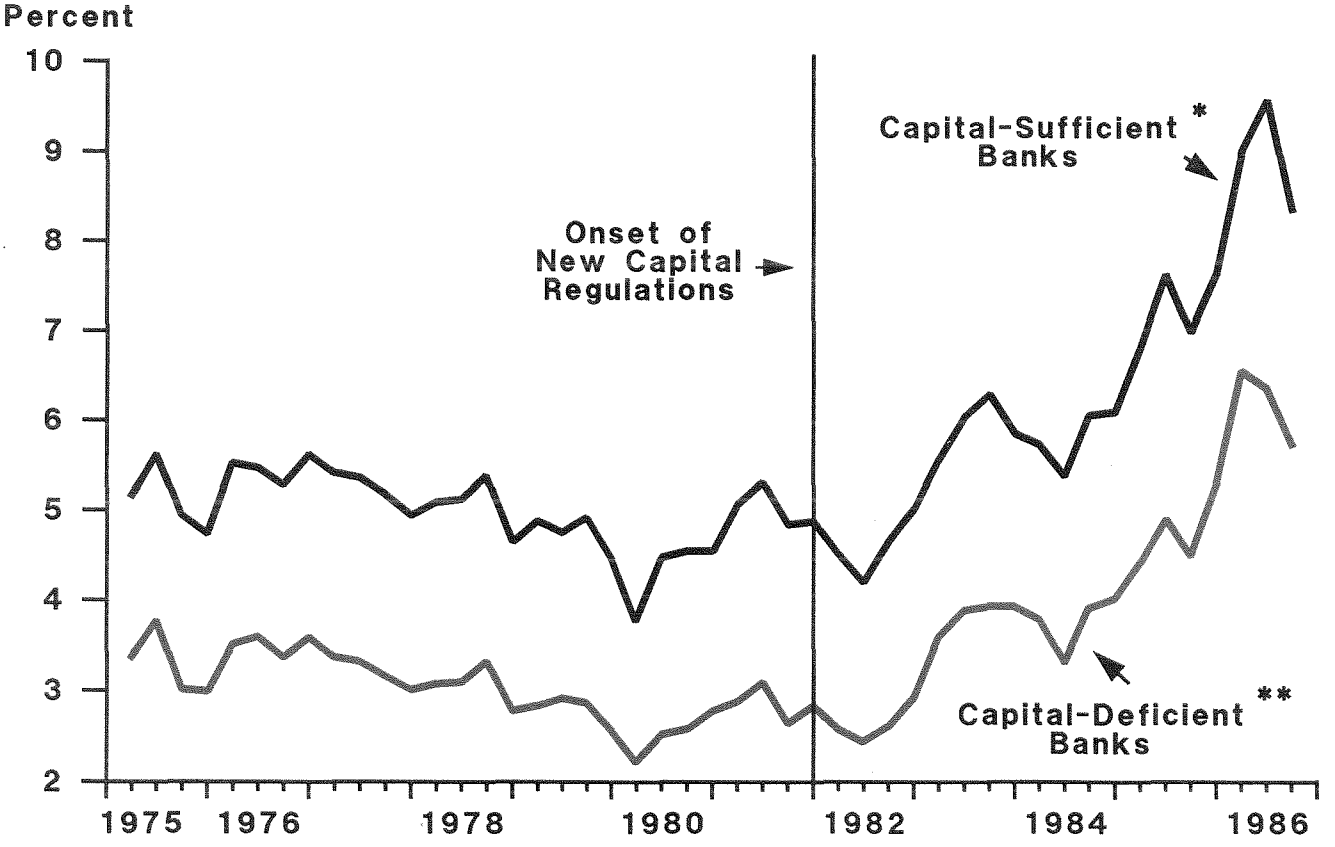
Table 7, which contains estimates of the mean market value capital-to-asset ratio for the two groups of banks at selected points in time, confirms the impression given by Chart 4. It shows that market value capital ratios increased significantly for both groups, but if anything, the increase was larger for the capital-sufficient group. Thus, unlike the results for book value capital-to-asset ratios (in Tables 2 and 3), capital-deficient banks did not experience a statistically significantly larger increase in their market value capital ratios.[14]

Since the market value capital ratios of the "control" group of capital-sufficient banks rose substantially, it seems likely that the *ceteris paribus* condition does not hold. That is, forces other than regulation were influencing equity-based measures of banks' market value capital ratios during the 1982–1986 period.

This raises the question of how to interpret the increases in market value capital ratios of the capital-deficient group. Were they the result of regulatory action or were they the result of other forces perhaps common

CHART 4

MARKET VALUE CAPITAL-TO-ASSET RATIOS



* *Banks that met 1985 requirements in 1981.*

** *Banks that did not meet 1985 requirements in 1981.*

to all banks? The answer depends on whether the forces affecting the capital-sufficient group had similar effects on the capital-deficient group. And there are several reasons they might have had differential effects, including 1) differential effects of overall stock price and interest rate trends on the two groups of banks, and 2) differential changes in regulatory taxes or subsidies.

Stock Market and Interest Rate Trends

It is possible that the market-value ratios of the capital-deficient group of banks did rise relative to the capital-sufficient group once the differential effects of changes in overall stock price and interest rates are taken into account. During the post-regulation period, overall stock prices rose dramatically and interest rates fell. Both of these changes are likely to cause, or to be associated with factors that would cause, bank stock prices to rise, and thereby raise equity-based measures of market-value capital-to-asset ratios. However, banks' stock prices may respond differently to such changes due to differences in their portfolios' credit and interest rate risk and market value leverage.

To investigate whether these trends can explain the apparently similar rise in equity-based market value capital ratios, the following test was performed. First, for the pre-regulatory change period, 1975Q1 through 1981Q4, each bank's market value capital ratio was regressed on the New York Stock Exchange Composite Index, the 20-year Treasury Bond rate, and the 3-month Treasury Bill rate. (Also, a dummy was included for the

Table 7

Mean Market-Value Capital Ratios, Selected Points in Time

(Standard Errors in Parentheses)

Period	Capital-Deficient Banks	Capital-Sufficient Banks	Difference
1974Q4–1981Q4	3.03 (.046)	4.97 (.036)	1.94* (.058)
1982Q1–1986Q3	4.14 (.084)	6.39 (.065)	2.25* (.11)
1981	2.86 (.11)	5.02 (.096)	2.16* (.15)
1982	2.64 (.099)	4.60 (.093)	1.96* (.14)
1983	3.84 (.14)	5.93 (.11)	2.09* (.18)
1984	3.76 (.13)	5.81 (.097)	2.05* (.16)
1985	4.77 (.17)	7.26 (.12)	2.49* (.21)
1986Q1–Q3	6.20 (.28)	8.97 (.18)	2.77* (.33)
1986 minus 1981	3.34* (.30)	3.95* (.20)	.61 (.36)

* *Significant at the 1 percent level.*

Table 8

Mean Forecast Errors: Market-Value Capital Ratios

(Standard Errors in Parentheses)

Period	Capital-Deficient Banks	Capital-Sufficient Banks	Difference
1982Q1–1986Q3	.39* (.090)	.17** (.070)	−.22** (.11)
1981	.090** (.039)	.18* (.032)	.090*** (.050)
1982	−.42* (.070)	−.60* (.072)	−.18*** (.10)
1983	.20 (.13)	−.12 (.11)	−.32*** (.17)
1984	.22 (.14)	−.14 (.12)	−.36*** (.18)
1985	.71* (.21)	.58* (.17)	−.13 (.27)
1986Q1–Q3	1.53* (.37)	1.43* (.28)	−.10 (.46)

* *Significant at the 1 percent level.*

** *Significant at the 5 percent level.*

*** *Significant at the 10 percent level.*

credit control period that affects the second quarter 1980 observation.) The resulting 103 regressions were used to forecast each bank's market value capital ratio for each quarter of the post-regulatory period.

Then the mean of the forecast errors (the actual market value capital ratio minus the forecast value) was computed separately for the two groups of banks for each year. A positive mean forecast error indicates that the capital ratio rose more than would be expected based on the historical relationship between that bank's equity-based market value capital ratio and overall stock prices and interest rates.

If regulation caused market value capital ratios to rise, larger positive forecast errors for the capital-deficient group would be expected. That is, capital-deficient banks' market value ratios should rise by more than would be predicted on the basis of the ratios' historical relationship to overall stock prices and interest rates, and also by more than capital-sufficient banks' market value capital ratios would be predicted to rise.

The results of this analysis, reported in Table 8, lend little support to this regulatory hypothesis. The positive forecast errors for the capital-deficient group suggest that some factor other than stock price or interest rate trends was positively influencing market value capital ratios, although the effect was not large until 1986.

Consistent with the hypothesis that regulation was the factor, the forecast errors for the capital-deficient group for the 1982-1986 period are somewhat larger than those of the capital-sufficient group. However, the magnitude of the difference is just .22 points, which sharply contrast with a difference of 1.20 points in the rise in book value capital ratios between the groups. Moreover, during 1986, when one would expect the largest difference in forecast errors (because of the effect of the 1985 regulations), the difference between the two groups is not statistically significant.

In sum, the rise in the market value capital ratios of capital-deficient banks relative to capital-sufficient banks is very small, even though controlling for the rise in stock prices and fall in interest rates provides some support for a relative rise. Moreover, the pattern of the increases does not parallel the differential rise in book value ratios. Taken as a whole, it does not appear that differential responses of capital-deficient and -sufficient banks to stock price and interest rate trends provide strong support for the regulatory hypothesis.

Regulatory Subsidies and Taxes

Another difficulty in interpreting the behavior of the equity-based market value capital ratio (using a bank's equity to measure its market value capital ratio) is that a bank's observed equity value can be affected by changes in regulatory subsidies and taxes.

For example, for a bank with subsidized deposit insurance (which underprices risk), an increase in true capital of a dollar reduces the deposit insurance subsidy by less than a dollar.[15] Since the decreased value of the subsidy in turn would be reflected in the bank's stock price, the total market value of the bank's observed equity-based capital would rise by less than a dollar and the observed market value capital ratio would rise less than the book ratio.[16]

If capital-deficient banks received larger capital infusions and their subsidies fell more than that of the capital-sufficient banks, it is possible that their true market value capital ratios would have risen more than those of the capital-sufficient banks (even though the equity-based measures rose by approximately the same amount).

Changes in asset risk also can alter the value of the deposit insurance subsidy, which depends positively on asset risk.[17] In particular, if capital-sufficient banks were to increase risk, their observed market value capital could increase even without a true capital infusion. This result would make it difficult to compare the changes in market value capital ratios between the two groups of banks, and thereby determine whether the capital-deficient banks actually increased capital.

Moreover, changes in relative taxes also can affect relative market values. For example, if the increase in capital ratios represented a higher tax for the capital-deficient group, perhaps because their asset portfolios were more heavily regulated, their per share stock prices would be depressed. As a result, the true market capital ratios of the capital-deficient group could have risen more, but the observed equity-based measure would not have reflected the higher value because the corresponding rise in regulatory taxes would have depressed per share stock prices.

Thus, from observed changes in the stock-price-based market value capital-to-asset ratio alone, one cannot determine whether asset risk changed, relative taxes changed, or capital ratios net of the subsidy changed. This issue is the subject of a companion paper in an upcoming *Review* (Furlong, 1988), which presents estimates of changes in regulatory subsidies/taxes over the period for the two groups of banks by estimating the option value of deposit insurance.

In sum, even though the changes in stock-price-based market value capital ratios are consistent with regulatory increases in capital for the capital-deficient banks, they are also consistent with several other hypotheses and thus do not provide independent support for the regulatory hypothesis.

VI. Summary and Conclusions

The evidence presented in this paper strongly suggests that uniform capital requirements achieved their intended effects on book or accounting measures of banks' capital-to-asset ratios. By 1986, virtually all banks were meeting the book value capital requirements. Moreover, the disparity of book capital ratios was reduced substantially – an effect consistent with the goals of the capital regulations.

Capital-deficient banks – those originally not meeting the requirements – increased their capital ratios primarily by slowing asset growth relative to capital growth. This suggests that the increase in book capital-to-asset ratios reflected a true reduction in leverage and not just an accounting gimmick.

Because of a rise in off-balance-sheet activity, primarily increased issuance of SLCs, standard book-value measures of capital ratios somewhat overstate the increase in capital ratios. However, even if the loans backed by SLCs had been funded on the balance sheet, book capital ratios for capital-deficient banks would have risen substantially over the 1982-1986 period.

Observed market value capital ratios (based on banks' stock prices) did increase overall, but there is no strong indication of a larger increase for capital-deficient banks. There are several explanations for this pattern consistent with a regulatory-induced increase in capital ratios for the capital-deficient banks. They include increased regulatory taxes or reduced subsidies, differential responses to overall stock price and interest rate changes, and differential changes in bank risk-taking. Although differential responses to stock price and interest rate trends do not appear to play a large role, this paper is unable fully to distinguish among the other hypotheses.

FOOTNOTES

1. A more recent study by Wall and Peterson (1985) presents indirect evidence from a complex structural two-regime model (which assumes that banks' capital ratios are determined either by regulatory or market forces) that, for the 1982 to 1984 period, most large BHCs' book value capital-to-asset ratios were influenced by regulatory forces. However, it appears that these findings may be very sensitive to model specification and validity, both of which are untested.

2. Minimum total capital requirements were also set at 5.5 percent and 6.5 percent for large and small banks, respectively.

3. Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin,* January 1982, p. 33.

4. 94 percent of the sample of multinationals did not meet the 1985 requirements in 1981, whereas only 10 percent of other banks in the sample did not meet the requirements. (The sample includes 16 of the 17 multinationals. Crocker Bank is excluded because Compustat does not maintain historical data on acquired banks.)

5. Board of Governors, *op cit.*

6. Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin,* June 1985, p. 446.

7. An interesting and important research question is why book capital had been declining over so long a period. However, since the objective of this paper is to analyze the effects of the 1981-1985 capital regulations, I restrict the analysis to the 7-year period, 1975-1981, before the onset of objective capital regulation and the 5-year period, 1982-1986, after. These periods were chosen partly because capital ratios were relatively stable during the 1975-1981 period and partly because more data are available for this period. Thus, I leave to future research the question of explaining the generally declining capital ratios before 1975.

8. I also examined the effects of the capital regulations on banks ranked by their 1981 book capital ratios. Estimates of the model similar to that described by equation 2 were obtained for banks in the lower half and the upper half of both the capital-deficient and capital-sufficient categories.

As expected, capital-deficient banks in the lower half of the rankings appeared to increase their target ratios more than those in the upper half. Moreover, unlike the pre-regulation period, there was no statistically significant difference in target levels during the 1982 through 1986 post-regulation period.

Similarly, those capital-sufficient banks in the upper half of the rankings may have reduced their target capital ratios (although not by a statistically significant amount), while those in the lower half did increase their target ratios by a statistically significant amount. Taken as a whole, these results suggest that all banks were trying to achieve book capital ratios closer to a given target level than in the pre-1982 period.

9. It is unclear whether a capital buffer would exist or even whether the concept of a buffer would be meaningful during the pre-1982 peer group type of capital regulation. If buffers did exist, it is likely that the target ratio being buffered would vary among different peer groups.

10. A similar test of whether the uniform capital regulations caused a decline in the overall standard deviation in capital

ratios (both across banks and over time) was also conducted. The results parallel those in Table 4 and suggest strongly that standard deviations declined, especially when the 1986 period is compared to the pre-regulation period. As in Table 4, there was a reduction in the dispersion of capital ratios among capital-sufficient banks as well as a narrowing of differences between the capital-deficient and -sufficient groups.

11. Another explanation is that the capital requirements in effect represented an increased regulatory tax which, in turn, caused these banks to shrink. However, since both groups of banks faced the same capital requirements, it is hard to see why these banks should face a higher regulatory tax than the capital-sufficient group unless they had much less risky asset portfolios and were constrained by regulators to maintain less risky portfolios—a hypothesis that seems unlikely, at least in retrospect.

12. Another reason is that a bank with underpriced deposit insurance will benefit from increasing asset size while holding constant the capital-to-asset ratio (see Furlong and Keeley, 1987b). Thus, regulators must impose asset growth restrictions on such banks to limit the potential exposure of the deposit insurance system. However, the gain from increasing asset size decreases as the capital-to-asset ratio increases. Thus, if deposit insurance were underpriced for this group of banks and if the stringency of asset size regulation remained unchanged, then one would expect banks to meet the new capital requirements through a decrease in asset growth relative to capital growth rather than through an increase in capital growth.

I also examined the sources of new capital growth. First, there was an increase in the rate of new equity issuance (scaled by initial assets) both for banks meeting and those not meeting the 1985 requirements in 1981.

Second, I found that dividend payout rates (as a fraction of net income before extraordinary items) were basically unchanged over the period. Moreover, there were no apparent differences in dividend payout rates between those banks meeting and those not meeting the 1985 requirements in 1981.

Finally, the rate of earnings retention (earnings available for common minus common dividend payments) scaled by initial assets was somewhat lower during the 1982-1986 period than during the 1975-1981 period.

13. It is possible for banks to sell appreciated assets and pay out part of the capital gains to stockholders and to use the remainder to boost bank capital. Although the bank's book capital ratio would rise and book assets would decline, the market capital ratios would fall. However, there is no strong evidence of increased payouts, either through dividends or stock repurchases to suggest that such a phenomenon occurred.

14. To test statistically whether the market ratio rose less than one-for-one with the rise in the book ratio for capital-deficient banks as Chart 4 suggests, the market-to-book ratio was regressed on the change in the book capital ratio (using 1981 as a base year) separately for capital-deficient and -sufficient banks. The hypothesis that an increase in book capital due to regulation should result in a smaller increase in observed equity-based market capital for capital-deficient banks than for capital-sufficient banks was confirmed.

There is a negative relation between increases in book capital and the market-to-book ratio for capital-deficient banks. In contrast, there is a zero, or even a small positive, relationship for capital-sufficient banks, and the difference in responses was statistically significant.

15. The reason the subsidy, which is the current value of a payout from the deposit insurance fund in the bankruptcy state, falls by less than one dollar is that even though a dollar of capital reduces the payout by one dollar (holding asset risk constant) when bankruptcy occurs, the current value of this one dollar reduction in the payment is less than one because the probability of bankruptcy is less than one.

16. Mathematically, the observed market-value capital-to-asset ratio would be:

$$R_0 = [C + S]/[A + S]$$

where:

C = market capital, not including deposit insurance

A = market assets, not including deposit insurance

S = market value of deposit insurance

Taking the derivative of R_0 with respect to C holding assets, A, and the risk of assets constant, yields:

$$dR_0/dC = [A(1 + dS/dC) + S - dS/dC]/(A + S)^2 > 0$$

17. That is, the observed ratio R_0 (see footnote 16) increases because:

$$dR_0/ds = [(A + S)dS/ds - (C + S)dS/ds]/(A + S)^2 > 0.$$

s = standard deviation of return on assets.

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